Scaling the EOS fragment yields

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The EOS fragment yields of 1 AGeV Au, La, Kr + C were fit to a form of Fisher's droplet model incorporating the Coulomb energy release when a particle moves from liquid to vapor [1]:

$$n_A = q_0 A^{-\tau} \exp\left(\frac{A\Delta\mu + E_{Coul} - c_0 \varepsilon A^{\sigma}}{T}\right), \tag{1}$$

where E_{Coul} is given by:

$$E_{Coul} = \frac{(Z_0 - Z)\, Z}{r_0 \left((A_0 - A)^{1/3} + A^{1/3}\right)} \left(1 - e^{-x\varepsilon}\right). \tag{2}$$

Here Z_0 and A_0 are the charge and mass of the fragmenting system; $r_0 = 1.2$ fm; the mass of a fragment prior to secondary decay is $A = 2Z(1 + (E^*/B_f))$; Z is the measured fragment charge; E^* is the excitation energy; B_f is the binding energy of the fragment; the temperature T was determined via a Fermi gas: $T = \sqrt{E^*/(A_0/8(1 + E^*/B_0))}$; B_0 is the binding energy of the fragmenting system.

Data from each system for 0.25 AMeV $\leq E^* \leq E^*_c$ and $4 \leq Z \leq Z_0/4$ were simultaneously fit to Eq. (1). The fit parameters τ, σ and c_0 were kept the same for all systems while $\Delta\mu$, x and y were allowed to vary between the systems to minimize χ^2_ν. The excitation energy at the critical point, shown in Table 1, E^*_c was determined by examining the fluctuations of the charge of the largest fragment [1].

Figure 1 shows the results. The yields, scaled by the power law pre-factor, bulk term and Coulomb term: $n_A/q_0 A^{-\tau} \exp(\Delta\mu A + E_{Coul}/T)$; and plotted against $A^{\sigma}\varepsilon/T$; collapse to the liquid-vapor coexistence line over eight orders of magnitude.

The values of $\tau = 2.2 \pm 0.1$ and $\sigma = 0.71 \pm 0.02$ are in the range expected for a three dimensional systems. The value of $c_0 = 14.0 \pm 1.0$ MeV is close to the surface energy coefficient of the liquid-drop model: 16.8 MeV.

Table 1: EOS Critical points

System	E^*_c (AMeV)	T_c (MeV)
Au + C	4.6 ± 0.2	7.6 ± 0.2
La + C	4.9 ± 0.2	7.8 ± 0.2
Kr + C	5.1 ± 0.2	8.1 ± 0.2

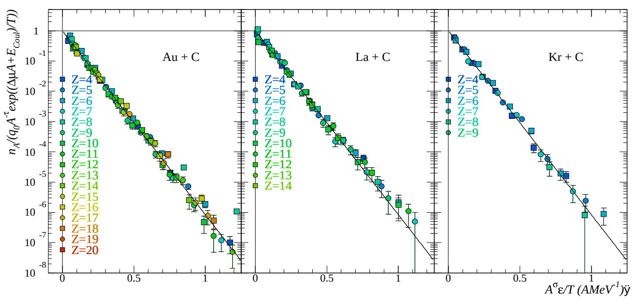

Figure 1: The scaled yield distributions for the gold, lanthanum and krypton systems.

Table 2 lists the fit parameter results. The $\Delta\mu$ values may indicate a super-saturated vapor, or unaccounted energy costs, or noise in the data. The x values may reflect the Coulomb energy of the system via the number of protons present or via the symmetry of the collision which affects the geometry of the remnant. The values of y returned indicate that the fragments have about the same A/Z ratio as the excited remnant.

References

[1] J. B. Elliott *et al.*, to be submitted to Phys. Rev. C (2002).

Table 2: EOS Fit parameter results

System	$\Delta\mu$ (AMeV)	x	y
Au + C	0.38 ± 0.02	1.1 ± 0.2	0.5 ± 0.1
La + C	0.47 ± 0.03	1.2 ± 0.1	0.3 ± 0.2
Kr + C	0.58 ± 0.08	4.0 ± 1.0	0.8 ± 0.2